THE CARL MOYER PROGRAM GUIDELINES

2006 Project Criteria for Light-Duty Vehicles

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California Environmental Protection Agency

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Chapter Eleven

LIGHT-DUTY VEHICLES

This chapter addresses the project criteria for on-road, light-duty vehicle projects. The chapter contains a brief overview of the light-duty vehicle emission inventory, current engine emission standards, available control technologies, potential projects eligible for funding, and emission reduction and cost-effectiveness calculations.

I. Introduction

Light-duty vehicles include passenger cars, pick-up trucks, sport utility vehicles (SUVs), and vans. In 2005, the estimated number of light-duty vehicles in California was over 21 million vehicles. Although emissions from light-duty vehicles are decreasing with the implementation of stricter emission control standards, light-duty vehicles are still major contributors to California's air pollution, and incentive programs offer a way to reduce emission from the existing fleet.

II. Emissions

The oxides of nitrogen (NOx), reactive organic gas (ROG), and particulate matter (PM10) emissions from the light-duty fleet are shown in Table 11-1.

Table 11-1
Statewide Emissions from On-Road Light-Duty Vehicles
(tons per day)

	Population	NOx	ROG	PM10
2005	21,500,000	574	583	29
2010	23,700,000	388	405	32

Source: ARB 2006 Almanac Emission Projection Data (http://www.arb.ca.gov/ei/emissiondata.htm)

Older, light-duty vehicles (pre-1990 model years) account for 56 percent of the ROG and 41 percent of the NOx emissions from all light-duty vehicles in 2005, despite accounting for only 19 percent of the vehicle population and less than 13 percent of the vehicle miles traveled (VMT). Generally, these older vehicles emit more pollutants because of less stringent emission standards and increased wear and tear on drive train and emission control components. Even well maintained, older vehicles tend to be higher emitting than newer ones because they lack advanced emission controls.

III. Regulatory Requirements

California's emission controls for light-duty vehicles date back to the 1960s. New control technologies and cleaner fuels have enabled more restrictive emission standards over the years.

Since the 1990s, the Low Emission Vehicle (LEV) regulations have been the cornerstone of the ARB's program to reduce emissions from light-duty vehicles. The LEV program, implemented in 1994, established four tiers of low emission standards and provided manufacturers with the option of certifying their vehicles to any mix of these standards as long as they complied with an average non-methane organic gas annual fleet requirement. The fleet average requirement gradually decreased each year between 1994 and 2003, resulting in the introduction of a greater number of cleaner vehicles each proceeding model year. The LEV II regulation set even more stringent, declining fleet average emission requirements for 2004 through 2010 and lowered the NOx emission standards. As a result of the ARB's LEV program, a new 2005 model year car is on average 99 percent cleaner than an uncontrolled car.

California also has requirements to ensure vehicles' emission control systems continue to work throughout their lives. Under the Smog Check program, vehicles are tested biennially to ensure that they stay clean as they age. A Smog Check includes a tailpipe emissions test and a visual inspection of the emission control system. For vehicles equipped with on-board diagnostic (OBD II) systems (model years 1996 and later), the inspection also includes a check of the malfunction indicator light to ensure that no problems have been detected with the vehicle's emission control system.

IV. Potential Projects: Voluntary Accelerated Vehicle Retirement and Voluntary Repair of Vehicles

Light-duty vehicle projects were added to the Carl Moyer Program with legislative changes signed into law in 2004 (AB 923). The ARB has identified two types of light-duty vehicle projects that are eligible for funding under the Carl Moyer Program: voluntary accelerated vehicle retirement (VAVR or vehicle scrapping) and voluntary repair of vehicles (VRV). Both programs can reduce excess emissions from older, high emitting vehicles. Some districts may choose to run only a VAVR program or only a VRV program; others may choose to run VAVR and VRV programs in coordination, so vehicle owners have the option of choosing between vehicle repair and retirement.

The ARB originally adopted project criteria for VAVR programs in the 2005 Carl Moyer Program Guidelines [ARB 2005]. This revision expands vehicle scrapping opportunities by adding criteria for the optional use of remote sensing devices (RSD) or other technologies to identify high emitting vehicles for participation in VAVR programs and establishing project criteria for VRV programs.

RSD typically uses infrared and/or ultraviolet spectroscopy to measure the concentrations of air pollutants in vehicle exhaust while the vehicle is in use on the roadway. Concentrations of ROG, NOx, and CO are recorded along with a photo of the license plate. Studies have shown that RSD can be an effective tool in identifying high emitting vehicles [BAR, 2001; U.S. EPA; Stedman, 1994; and Stedman].

A. VAVR Background

The goal of VAVR programs is to retire older, more polluting vehicles earlier than their expected lifetime, thereby eliminating the emissions associated with their operation. VAVR programs are strictly voluntary programs overseen by the ARB and administered by local air districts. Private enterprise operators are contracted by the district and are responsible for evaluating, approving, and disposing of qualified light-duty vehicles. Real emission reductions can be achieved as vehicles are still fully operational and have a useful life remaining. Therefore, to qualify for a VAVR program, a vehicle must meet registration, functionality, and equipment eligibility criteria. To accommodate car collectors and others with potential interest in vehicles offered for retirement, VAVR programs provide the public with an opportunity to purchase vehicles in whole or in part before the vehicle is retired. Vehicles accepted into the program must be retired by crushing the vehicle to such a degree that it and its parts are rendered unusable.

The California Health and Safety Code (sections 44100-44122, in part) establishes the framework for VAVR programs. As required in State law, the ARB has adopted a regulation governing VAVR programs that includes market-based, privately-operated VAVR enterprises and the generation of emission reduction credits. [ARB, 1998 and ARB, 2001] The VAVR regulation now provides for the optional use of technologies to identify high emitting vehicles [ARB, 2006].

In addition to district administered VAVR programs, BAR's Smog Check Program includes a voluntary vehicle retirement element. As part of BAR's Consumer Assistance Program, owners of qualifying vehicles that fail the biennial Smog Check are given the option of voluntarily retiring their vehicle rather than repairing it. District-run VAVR programs complement BAR's Smog Check Program. District programs generate emission reductions that are surplus to those obtained through the Smog Check. BAR's program covers vehicles that have failed their biennial Smog Check while the district programs cover vehicles that have passed their biennial Smog Check or are between biennial inspections (i.e., "off-cycle" from Smog Check).

Two types of VAVR programs are allowed which we refer to as "conventional VAVR programs" and "high emitter VAVR programs," respectively. In conventional VAVR programs, any older vehicle may be retired provided it meets the minimum eligibility requirements. Emission reductions are achieved because these older vehicles, even ones that meet their Smog Check standards, emit more pollutants than the newer vehicles that replace them upon retirement. To estimate the emission reductions, the retired vehicle's emissions are not directly measured, so it is assumed that the retired vehicle produces the average emissions of its model year. In addition, because a replacement vehicle's emissions are not measured and the vehicle chosen as a replacement is not specified, it is assumed that the replacement vehicle produces the emissions of a "fleet average" vehicle. The Carl Moyer Program Guidelines include a look up table which lists emission reductions by model year of vehicle retired.

In high emitter VAVR programs, RSD or other technologies are used to identify the highest emitting vehicles in the fleet for possible participation. By targeting only the highest emitting vehicles, the programs can achieve extra emission reductions relative to conventional VAVR programs. The conventional VAVR emission reduction tables cannot be used to estimate the reductions for this type of program because the tables do not reflect the fact that only the highest emitting vehicles would be targeted for voluntary participation. The Carl Moyer Program Guidelines provide the method for calculating the emission reductions for high emitter VAVR programs.

Districts interesting in running VAVR programs with Carl Moyer Program funds would have the option of choosing which type of program to operate.

B. VRV Background

Funding voluntary emission-related repairs can reduce emissions from the existing fleet. Vehicle repair projects must achieve surplus emission reductions to receive funding under the Carl Moyer Program. Vehicle owners routinely pay for repairs on their own vehicles. Simply shifting the cost of repairs from the owner to the State does not, in and of itself, result in surplus emission reductions. Surplus emission reductions are achieved only by funding repairs that would not have occurred otherwise or by accelerating repairs so they occur earlier than they would have otherwise. Distinguishing repairs that would only occur with State funding from those that would have happened in the absence of funding ("anyways reductions") is a challenge. To ensure emission reductions are surplus to the Smog Check program, vehicles must be outside of their biennial Smog Check window in order to participate.

It is also important that incentive-based repair programs do not discourage vehicle owners from keeping up with routine vehicle maintenance. Only vehicles identified through remote sensing, high emitter profile, or equivalent technologies are eligible for VRV. VRV programs would not be open to "walk ins" (i.e, vehicles not identified as possible high emitters) because this would create a disincentive for people to keep up with routine vehicle maintenance.

Also critical to the success of vehicle repair projects is ensuring that emission control system failures are correctly diagnosed and repaired so that real emission reductions are achieved. To address this, project criteria require systematic diagnosis and repair in accordance with standard industry protocols to ensure that vehicles are correctly and efficiently repaired.

During the development of these Guidelines, some stakeholders suggested that State-funded voluntary repair programs be available only to low income vehicle owners because they are least financially able, and therefore least likely, to make the repairs in absence of State funding. ARB staff acknowledges this concern. However, it's been ARB policy with respect to the Carl Moyer Program to provide a broader level of guidance sufficient to ensure that emission reductions are real, quantifiable, enforceable, and surplus. The ARB leaves decisions on how Carl Moyer Program funds

should be distributed to the air districts administering the program at the local level. ARB staff agrees that this is an issue that air districts should consider as they design VRV programs.

C. New Elements: Light-Duty Vehicle Carl Moyer Program Projects

The following section provides background on the new elements of the Carl Moyer Program Guidelines for light-duty vehicle programs.

- Provisions for high emitter VAVR programs which utilize technologies such as RSD to identify possible high emitting vehicles.
- A method to calculate the extra emission reductions for retiring vehicles identified as high emitters.
- Project criteria for VRV programs.

1. Identifying High Emitting Vehicles for VAVR or VRV

High emitter VAVR or VRV programs would incorporate RSD, high emitter profiles, or equivalent technologies to identify candidate vehicles. However, emission reduction estimates are not based on these measurements. Instead, the vehicle's emissions are based on a confirmatory Smog Check test which would be used to establish the vehicle's baseline emissions. At this time, ARB staff does not believe that a split second RSD measurement is quantitatively reflective of a vehicle's emissions over a driving cycle.

To be eligible for high emitter VAVR or VRV programs, an identified vehicle's confirmatory Smog Check test would need to exceed the pass/fail emission standard (cutpoint) for the model year and vehicle class. For the purposes of this program, a high emitting vehicle is defined as one that fails the Smog Check test. Vehicles whose emissions are below the pass/fail emission standard could still be voluntarily retired and receive the emission reductions for conventional VAVR programs. For vehicles that are not testable on the acceleration simulation mode (ASM) testing equipment, a two speed idle (TSI) Smog Check may be substituted.

2. Calculating Emission Benefits of High Emitter VAVR

The same fundamental approach that is used for conventional VAVR programs to estimate emission reductions is used for retiring high emitting vehicles. However, the input variables would be different, reflecting the fact that the retired vehicle has been identified as a high emitting vehicle and its emissions have been measured. Unlike conventional VAVR programs, which assume retired vehicles pass Smog Check, high emitting vehicles identified off-cycle would presumably fail their next Smog Check. Consequently, the emission rate of the retired vehicle would change over the credit life. It would be higher before the vehicle's next biennial Smog Check, but after the Smog Check, its emissions would be lower because it would have had to be repaired in order to stay on the road.

For the first year of the three year credit life, a retired vehicle's baseline emissions would be equal to the confirmatory Smog Check ASM reading converted to a federal test procedure (FTP) based gram per mile emission rate using conversion equations developed from the *2004 Evaluation of the California Enhanced Inspection and Maintenance (Smog Check) Program*. [ARB/BAR, 2004; ARB/BAR, 2005]

For years two and three of the credit life, its emissions would have been lower because, had it not been retired, it would have presumably failed its Smog Check and been repaired to pass Smog Check. ARB staff proposes that the retired vehicle's baseline emissions for years two and three be equal to the Smog Check pass/fail emission cutpoint pollutant concentrations for the vehicle class and model year, converted to an FTP based gram per mile emission rate. This approach assumes retired vehicles are one year away, on average, from their next biennial Smog Check. Some vehicles may fail the Smog Check test for only one pollutant. If a vehicle's emissions at time of retirement were below the Smog Check pass/fail cutpoint for a pollutant, the emissions for that pollutant would be equal to its measured emissions at the time of retirement because the Smog Check program would not have forced any reduction of the passing pollutant.

ARB staff recommends using the average VMT of the model year of the vehicle retired as with conventional VAVR. Staff considered the alternative of estimating an individual vehicle's VMT based on the difference in odometer reading between its last two Smog Checks. This approach was suggested when the VAVR regulation was last updated in 2002. At that time, ARB staff concluded that the Smog Check odometer data were not sufficiently reliable because a portion of these data are inaccurate. However, as part of the flexibility provided in the Guidelines, districts have the option of using actual mileage if that proves feasible in the fleet of vehicles being retired.

Emissions of the replacement vehicle would be equal to the average emissions of the light-duty fleet, and the VMT of the replacement vehicle would be equal to that of the retired vehicle as with conventional VAVR. This reflects the fact that owners are not required to document how they replace the vehicles they retire. However, some air districts and other stakeholders have expressed interest in allowing programs which provide additional incentives for owners who document that they have purchased a vehicle certified to the ARB's LEV or cleaner emission standard. In this case, the replacement vehicle's emission rate would be the average emission rate of a LEV-certified vehicle of the model year purchased, based on the ARB's motor vehicle emission model.

3. Repair Requirements

A guiding principle for the vehicle repair requirements is that vehicles must be systematically diagnosed and repaired by licensed Smog Check technicians in accordance with accepted industry protocols and all laws and regulations governing automotive repair to ensure that repairs are durable and real emission reductions are

achieved. Systematic diagnosis and repair is the key to successful repair programs. Quick and inexpensive repairs which temporarily mask more serious problems do not result in long lasting emission reductions.

ARB staff has based its repair criteria on the protocols used in BAR's Consumer Assistance Program. The ARB encourages air districts to pay careful consideration to the need for systematic diagnosis and repair protocols as they develop contracts with the Smog Check stations to perform the testing, diagnosis, and repair services. The contracts should include the appropriate detail in the scope of work to ensure that stations follow systematic diagnosis and repair protocols.

4. Evaporative Emission Reductions

RSD does not measure evaporative emissions, and high emitter profiles do not predict the likelihood of evaporative Smog Check failures. Vehicles identified as high exhaust emitters do not necessarily have high evaporative emissions as well. ARB staff is providing districts the option of including an evaporative emission element in their higher emitter VAVR or VRV programs. Districts may conduct evaporative emission testing of vehicles identified as exhaust high emitters if they choose.

One challenge associated with testing vehicles' fuel evaporative systems is that the test equipment is still under development. BAR is in the process of developing regulations to add a low pressure fuel evaporative test to the Smog Check program, but at this time, no equipment has been certified by BAR. However, several manufacturers' equipment are undergoing certification. Only equipment that has been submitted for certification may be used in programs that test for evaporative emissions. If vehicles fail the low pressure evaporative, they would be eligible for extra evaporative emission reduction credits if retired or could receive repairs of evaporative controls.

Calculating the emission reductions associated with retiring or repairing vehicles identified as evaporative high emitters presents a challenge because the low pressure evaporative testing equipment does not directly measure a mass-based emission rate. Consequently, the emission benefits cannot be measured directly. Staff has based the emission reductions on pilot studies by the ARB and others that quantified in the laboratory the benefits of repairing vehicles which failed the low pressure evaporative test. (See *Environmental Impacts of Implementing A Low Pressure Evaporative Test in the California Smog Check Program*, released November 29, 2005, http://www.arb.ca.gov/msprog/smogcheck/evap_report.pdf.) [ARB, 2005] The report presents baseline evaporative emission rates and average control factors for repairs from which ARB staff estimated an average emission reduction.

During the final workshop on these revisions, one commenter suggested that vehicles identified as "liquid leakers" during the confirmatory Smog Check test should also qualify for extra emission reductions if retired or if those leaks are repaired. ARB staff agrees but has not yet developed a proposed method for calculating benefits. ARB staff

will work with air districts to appropriately quantify these emission reductions if they are a part of a district's VAVR or VRV program.

5. PM Emission Reductions

Identification of PM high emitters is not a standard part of VAVR or VRV programs. RSD and high emitter profiles have not been demonstrated as tools to identify PM high emitters, and vehicles identified as having high ROG or NOx exhaust emissions do not necessarily produce high PM emissions as well. The ARB supports the goal of reducing PM emissions from the light-duty fleet and is funding research into measuring PM emissions in light-duty vehicles. A further challenge in quantifying PM emissions is that the Smog Check ASM test does not measure PM.

ARB staff acknowledges that the South Coast AQMD will attempt to evaluate methods for identifying and quantifying PM high emitters as part of its high emitter retirement and repair program. ARB staff supports assigning extra PM emission reductions for retirement or repair once a viable, technologically supportable method of quantifying PM benefits is demonstrated.

The Guidelines include broad provisions for PM high emitter programs. If a district program includes a PM component, the program plan must specify the procedure and analytical approach that would be used to measure PM. The plan must also outline how the district intends to evaluate and validate that its proposed method of measure PM emissions in the field correlates with scientifically accepted methods of measuring PM emissions in the laboratory. However, because of the uncertainties in measuring PM, districts may not rely on the extra emission reductions from retiring PM high emitters to show that the program is cost-effective at this time.

6. Credit Life

The current VAVR program uses a three year credit life. Surveys conducted since the regulation was adopted in 1998 support the three year credit life. These surveys conducted in the Bay Area and South Coast indicate that owners estimated their vehicles would have lasted on average 3-3.5 years if they had not been retired. The South Coast data are from the 1999 time frame. However, Bay Area survey data are available from as recently as 2004-2005. Some have argued that regional differences may support a longer credit life. On the other hand, a high emitting vehicle may actually have a shorter life due to its need for potentially costly repairs. At this time, ARB staff does not have data that would support changing the credit life.

For VRV projects, the credit life is one year because, on average, vehicles are one year away for their next biennial Smog Check. To ensure that emission reductions are surplus to the Smog Check program, the credit life of the repair is the period of time between the repair and the vehicle's next scheduled Smog Check. At that time, the Smog Check program would have forced the reductions to occur, so they would no longer be surplus.

The one year credit life for repairs is an exception to the three year minimum project life in the Carl Moyer Program, reflecting the unique nature of vehicle repair projects. The ARB has set a three year minimum project life for other source categories to ensure emission reductions are surplus, particularly for projects funded in advance of regulatory compliance deadlines where engine owners know they will need to repower or replace their equipment. Vehicle repair is unique because, in absence of being identified via RSD or other technology, motorists may not know their vehicles need repairs until the time of their next Smog Check. By accelerating repairs a year before the Smog Check program would have required them, surplus reductions are achieved.

7. Cost-Effectiveness for High Emitter VAVR and VRV

For the Carl Moyer Program, the ARB considers program costs to be those directly related to repowering, replacing, or retrofitting an engine. All other costs are considered administrative. Administrative funds are not included in the program cost-effectiveness calculations but must be accounted for relative to the administrative limits associated with each funding source.

Costs directly related to identifying potential high emitting vehicles and the costs to repair or retire vehicles are program-related. These include the actual costs of remote sensing measurements; the costs of contacting potential participants, the costs of the Smog Check tests required to confirm candidate vehicles' emissions; and the cost of diagnosing vehicles for repairs. ARB staff considers funds spent on outreach, data analysis, and development of data analysis tools such as databases to be administrative costs.

Evaluating the cost-effectiveness presents unique challenges not seen in other Carl Moyer Program source categories. For all other categories, potential grant recipients submit applications in advance. During the application period, each project is evaluated to ensure that it meets the Carl Moyer Guidelines' project criteria and cost-effectiveness limits. Projects that are identified as cost-effective may then be eligible to receive funding. For VAVR and VRV programs, a different dynamic exists.

The nature of these voluntary programs does not allow an opportunity to fully assess the cost-effectiveness during an application period. Costs are incurred up front to identify and diagnose high emitting vehicles. However, the benefits cannot be fully estimated in advance because they depend on the participation rate and the mix of vehicles retired or repaired. The cost-effectiveness can only be calculated after the fact.

In addition, the nature of repair programs may lead to stranded costs that do not result in emission reductions. A Smog Check technician must take time to diagnose a vehicle to assess whether it is a good candidate for repair. Technicians may find that some vehicles are either not repairable or would be prohibitively expensive to repair. While no emission reductions would be achieved from these vehicles, funds would be expended in conducting the diagnosis. These stranded costs must be accounted for.

For VAVR and VRV programs, the costs to identify high emitting vehicles and diagnose them are distributed across the successfully repaired vehicles. Therefore, VAVR and VRV programs would individually need to meet the Carl Moyer Program cost-effectiveness limit. This reflects the unique nature of these programs and should not be considered a precedent applicable to other source categories. Cost-effectiveness for all other source categories would continue to be fully evaluated in advance on an engine by engine basis.

8. Flexibility in Program Design

Air district representatives have encouraged the ARB to provide flexibility for districts to develop specialized programs to address unique, local circumstances. They've noted that districts may be overly limited in designing programs if the program criteria are too prescriptive. ARB staff agrees that districts need flexibility, provided they incorporate sufficient controls to ensure the emission reductions are real, quantifiable, enforceable, and surplus. ARB staff has attempted to incorporate this flexibility into the Guidelines.

Some stakeholders have voiced the concern that a "one size fits all" approach may not work for the calculation methodology. ARB staff has provided a calculation methodology that works in most cases. However, if a district implements a narrowly focused program, the variables specified in the ARB's guidance may not be appropriate to reflect the district's program. Districts have the option of proposing modifications to the calculation methodology, where necessary, to reflect unique elements of their program. Any proposed modifications must be included in the district's program plan. The onus is on the district to document that the proposed modifications are technically sound and justified. The district must have ARB approval to use an alternative methodology.

V. Project Criteria for VAVR and VRV

This section provides the project criteria for VAVR and VRV programs funded through the Carl Moyer Program. Unless noted, the criteria apply to both VAVR and VRV programs. VAVR programs must also comply with all provisions of the regulations found in Title 13 California Code of Regulations, Division 3, Chapter 13, Article 1, section 2601 et seq.

These criteria provide districts with the minimum qualifications for the Carl Moyer Program. Districts retain the authority to impose additional requirements to address local concerns.

A. General Requirements

- Emission reductions obtained through Carl Moyer Program projects must not be required by any federal, state, or local regulation; memorandum of

agreement/understanding with a regulatory agency; settlement agreement; mitigation requirement; or other legal mandate.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + combustion PM10 reduced calculated in accordance with the cost-effectiveness methodology discussed in this chapter.

- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits or to offset any emission reduction obligation of any person or entity.

- Potential projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to the ARB suggests potential surplus, real, quantifiable, and enforceable emission reduction benefits.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

- Programs utilizing funding under the Carl Moyer Program shall comply with all applicable provisions of the Carl Moyer Program Guidelines including "Administration of the Carl Moyer Program."

B. Vehicle Eligibility Requirements

- Participation shall be entirely voluntary for vehicle owners.

- The vehicle must be a gasoline-powered passenger car or light-duty truck up to 8,500 pounds gross vehicle weight.

- The vehicle must be currently registered with the Department of Motor Vehicles (DMV) as an operating vehicle and must have been registered for at least 24 consecutive months prior to the final date of the sale to a VAVR enterprise or the date of repair to an address, or addresses, within the district in which the VAVR enterprise or VRV program is operated. Smog Checks must be performed as required by the DMV in order for the vehicle to be considered registered.

    1. A vehicle may also be eligible if the owner of the vehicle placed the vehicle in planned non-operational status per Vehicle Code section 4604, et seq., for a total of 2 months during the continuous 24 month registration period, occurring at least 3 months prior to the date of sale to the VAVR enterprise or the date of repair.

    2. A vehicle may also be eligible if the registration has lapsed for a period not to exceed 180 days during the previous 24 months and all appropriate registration fees and late penalties have been paid to the DMV, provided that the vehicle is

registered for at least 90 days immediately prior to its date of sale to a VAVR enterprise or date of repair.

- The vehicle to be retired shall be driven to the VAVR enterprise purchase site or VRV repair station under its own power.

- The vehicle to be retired shall not be operating under a Smog Check repair cost or economic hardship waiver.

- Vehicles whose emission control systems have been tampered with, as defined in Title 16 California Code of Regulations, Division 33, Chapter 1, Article 5.5, section 3340.41.5, are not eligible until such tampering has been completely corrected.

Additional Requirements for VAVR Programs Only

- If a vehicle volunteered for retirement is within 60 days of its next required Smog Check inspection, the vehicle shall pass the Smog Check inspection without receiving a repair cost waiver or economic hardship extension prior to acceptance by a VAVR enterprise operator.

- If a vehicle volunteered for retirement is within 61-90 days of its next required Smog Check inspection, the district shall verify that the vehicle has not failed a Smog Check inspection during this time frame.

- The vehicle shall pass functional and equipment eligibility inspections as specified in the ARB's VAVR regulation.

Additional Requirements for High Emitter VAVR or VRV Programs

- Only vehicles identified as potential high emitting through a technology such as RSD or a high emitter profile database approved by the ARB and operated in accordance with the VAVR regulations found in Title 13 California Code of Regulations, Division 3, Chapter 13, Article 1, section 2601 et seq. are potentially eligible for VRV programs or to receive extra emission reduction credit for VAVR programs.

- A vehicle must receive a confirmatory Smog Check ASM test to establish its baseline emissions. To be eligible for a VRV program or to receive extra emission reduction credit from a VAVR program, a vehicle's ASM test must exceed the pass/fail emission standard for the model year and vehicle class as defined in Title 16, Division 33, Chapter 1, Article 5.5, Section 3340.42 of the California Code of Regulations. The emission standards are listed on BAR's web site at: http://www.smogcheck.ca.gov/ftp/pdfdocs/asm_ph43.pdf.

  – Vehicles not testable under the ASM test may be given a TSI Smog Check test to determine eligibility.

- If the vehicle's emissions are below the pass/fail emission standards, the vehicle is not considered a high emitting vehicle. These vehicles could still be voluntarily retired and receive the emission reductions from a conventional VAVR program but do not quality for a VRV program.

- For pre-1974 model years, the pass/fail emission standards for the 1974 model may be used for purposes of qualifying vehicles for the program.

- The Smog Check test must be conducted by a BAR-licensed technician and must be conducted in accordance with BAR regulations and procedures.

Additional Requirements for VRV Programs Only

- All repairs must be completed at least 91 days in advance of the vehicle's next biennial Smog Check.

- Vehicles covered under their manufacturer's warranty period are not eligible. Warranty requirements are found in Title 13 California Code of Regulations, Division 3, Chapter 1, Article 6, section 2035 et seq. and Article 1, section 1961.

  - Manufacturer warranties generally cover vehicles for a period of 3 years or 50,000 miles whichever first occurs, with high-priced parts covered for a period of 7 years or 70,000 miles whichever first occurs.

  - For 2004 model year and newer vehicles certified to optional 150,000 mile emission standards, the high-priced part warranty is extended to 8 years or 100,000 miles whichever first occurs.

- Vehicles registered to a non-profit organization, fleet, or business are not eligible.

- A vehicle may only be repaired once in its lifetime through a VRV program.

C. Program Plan Requirements

- A district shall submit a program plan to the ARB for approval prior to initiating a VAVR or VRV program.

- The district must receive written approval of the plan from the ARB's Executive Officer (EO) prior to implementing a VAVR or VRV program.

- The program must follow the plan, and any substantive changes must be pre-approved by the EO.

- A district's program plan must at a minimum include:

1. The name, title, and telephone number of the district contact for the program.

2. An evaluation of environmental justice considerations including, but not limited to, outreach addressing community needs.
3. An estimate of the number of vehicles that may be retired and/or repaired and an estimate of the cost-effectiveness of the program along with all assumptions and calculations that were used to derive the estimate (recognizing that the ultimate cost-effectiveness will depend on the mix of vehicles actually retired/repaired).
4. A copy of the contract with the VAVR enterprise operations, repair stations, and any other contractor(s) who will be responsible for running the program.
5. A description of the methods that will be used and a timetable for monitoring and auditing enterprise operations and/or repair stations.
6. A copy of the statement of certification that a VAVR enterprise operator has demonstrated compliance with all applicable provisions of the VAVR regulation.
7. The methodology and sample records for verifying that a vehicle is eligible for inclusion in the VAVR program including confirmation of compliance with any Smog Check requirements.
8. The protocol for informing the public of the availability of eligible vehicles for sale (applies to VAVR programs only).
9. A sample of the records that will be required of the VAVR enterprise operator and/or repair stations.
10. A description of elements of the district program that are stricter than the minimum requirements listed in the guidance, if applicable.

<u>Additional Requirements for High Emitter VAVR and VRV Programs</u>

- The plan must also include:

    1. A detailed description of the operation of the technology including but not limited to set up, typical operation, location and location criteria, calibration, and maintenance.
    2. A detailed description of the type and model of all equipment and software used to identify high emitting vehicles.
    3. A copy of the standard operating procedures or protocols for that technology including maintenance of the technology including equipment and software.
    4. The specific criteria to be used in the application of the technology to identify a high emitting vehicle.
    5. Documentation that personnel who will be operating the technology are trained and qualified for such operation.
    6. A detailed description of the methodology that will be used to calculate extra emission reductions, including any deviations from the ARB's recommended method.
    7. If a district intends to include an evaporative testing element in its program, the plan must specify the test equipment.
    8. If a district intends to include a PM testing element in its program, the plan must specify the test equipment and test protocol.

9. A scope of work for the business(es) that will be performing the vehicle testing and repairs including the general diagnosis and repair protocols to ensure cost-effective and durable repairs (for VRV programs only).
10. An itemized breakdown of estimated project costs including, but not limited to, the funds allocated to: identifying high emitting vehicles (e.g. RSD data collection costs); vehicle retirement including the number of vehicles to be retired; the funds allocated to vehicle repair and the number of vehicles to be repaired; data analysis; and outreach to and solicitation of vehicles owners.

D. Recordkeeping and Reporting

- For each vehicle retired or repaired, the district shall retain records of the following information. This information must be included in the annual report to the ARB:

1. Vehicle Identification Number (VIN).
2. Vehicle license plate number.
3. Vehicle model year.
4. Vehicle odometer reading.
5. Vehicle make and model.
6. Name, address, and phone number of legal vehicle owner(s).
7. Name and business address of the VAVR enterprise operator or of the business conducting the repair.
8. Emission reduction claimed.
9. Date of purchase of vehicle by enterprise operator. [VAVR only]
10. Date of vehicle retirement. [VAVR only]
11. Amount paid for each repair and nature of each repair. [VRV only]
12. Date of repair. [VRV only]
13. Pre and post-repair Smog Check test results [VRV only]
14. Data identifying vehicle as potential high emitting vehicle for VAVR or VRV participation. [High Emitter VAVR or VRV only]
15. Confirmatory Smog Check test results and date of Smog Check test. [High Emitter VAVR or VRV only]

- For VAVR programs, the VAVR enterprise operator must maintain the following records. The records are <u>not</u> required to be part of the annual report, but must be available for review, if requested:

1. Reproduction of California Certificate of Title and registration, as signed-off by the seller at time of final sale to the VAVR enterprise.
2. Reproduction of the applicable certificate of functional and equipment eligibility;
3. Reproduction of the applicable Notice to Dismantler (DMV Registration 42 form).
4. Reproduction of written documentation from the DMV verifying that a vehicle meets the vehicle registration requirements of the ARB's VAVR regulations.
5. If the retired vehicle was within 60 days of its next required Smog Check inspection, a reproduction of documentation that the vehicle passed its Smog Check inspection.

- Districts and enterprise operators shall retain these records for the life of the project plus an additional 3 years.

E. Calculating Emission Reductions

1. Conventional VAVR Program Emission Reductions

- Emission reductions from VAVR programs shall be calculated in accordance with the methodology specified in the ARB's VAVR regulations. Emission reductions, by model year of vehicle retired, are shown in Table 11-2 (at the end of the chapter).

- The project life for a vehicle retirement project is 3 years.

2. High Emitting VAVR Program Emission Reductions

The emission reductions for high emitting VAVR programs are calculated as follows:

Emission Reductions = $[ER_{retired} * VMT_{retired} - ER_{replacement} * VMT_{replacement}] * Life_{retired}$

Where: $ER_{retired}$ = Emission rate of retired vehicle
$VMT_{retired}$ = Vehicle miles traveled of retired vehicle
$ER_{replacement}$ = Emission rate of replacement vehicle
$VMT_{replacement}$ = Vehicle miles traveled of replacement vehicle
$Life_{retired}$ = The remaining life of the retired vehicle

a. Exhaust Emissions of Retired Vehicle

- For year 1 of the 3 year project life, the baseline ROG_{ex}, NOx, and CO emission rates are equal to the pollutant concentrations measured in the confirmatory ASM Smog Check test converted to an FTP-based gram per mile emission rate using the conversion listed in Table 11-3 (at the end of the chapter).

  – For vehicles exempt from Smog Check (pre-1976 model years), the emissions measured at time of retirement are the baseline emissions for the full 3 year credit life.

- For years 2 and 3 of the 3 year project life, the baseline ROG_{ex}, NOx, and CO emission rates are equal to the lesser of the two following values:

  – The Smog Check pass/fail emission cutpoint pollutant concentrations for the model year and vehicle class converted to an FTP based gram per mile emission rate using the conversion equations in Table 11-3.

- The pollutant concentration measured in the ASM test at the time of retirement, converted to an FTP based gram per mile emission rate using the conversion equations used in Table 11-3.

- The VMT is the average VMT of the vehicle's model year based on the ARB's motor vehicle emission model. The average VMT for each model year is listed in Table 11-4.

b. Exhaust Emissions for the Replacement Vehicle

- If the vehicle owner is not required to document how the retired vehicle is replaced, the replacement vehicle emissions are assumed to equal fleet average emission rate calculated using the ARB's motor vehicle emission model.

  For vehicles retired in 2007, the replacement vehicle emission rates are:

ROG Exhaust g/mile	ROG Evap Running Loss g/mile	ROG Evap Hot Soak g/trip	ROG Evap Diurnal+Resting g/day/vehicle	CO Exhaust g/mile	NOx Exhaust g/mile	PM10 Exhaust g/mile
0.344	0.248	0.296	1.85	6.20	0.573	0.015

  For vehicles retired in 2008, the replacement vehicle emission rates are:

ROG Exhaust g/mile	ROG Evap Running Loss g/mile	ROG Evap Hot Soak g/trip	ROG Evap Diurnal+Resting g/day/vehicle	CO Exhaust g/mile	NOx Exhaust g/mile	PM10 Exhaust g/mile
0.310	0.232	0.285	1.77	5.69	0.542	0.016

  Note: Emission rates calculated using EMFAC Working Draft 2B (June 2006). Numbers are subject to change pending final version of emission inventory model.

- If a VAVR program is set up to provide extra incentives for the purchase of a LEV-certified or cleaner replacement vehicle and if the owner documents that the replacement vehicle is certified to a LEV or cleaner emission standard as defined in the ARB's LEV regulations (Title 13, Division 3, Chapter 1, Article 1, Sections 1960.1 and 1961 of the California Code of Regulations), the replacement vehicle emissions are assumed to equal the average emission rate of a vehicle certified to the LEV emission standard for the model year purchased as a replacement, based on ARB's emission model.

  For vehicles retired in 2007, the replacement LEV emission rates by model year are:

LEV Model Year	ROG Exhaust g/mile	ROG Evap Running Loss g/mile	ROG Evap Hot Soak g/trip	ROG Evap Diurnal+Resting g/day/vehicle	CO Exhaust g/mile	NOx Exhaust g/mile	PM10 Exhaust g/mile
1997	0.108	0.084	0.151	0.651	3.979	0.354	0.019
1998	0.102	0.073	0.130	0.566	3.843	0.347	0.018
1999	0.097	0.062	0.109	0.495	3.679	0.334	0.016
2000	0.092	0.050	0.086	0.412	3.494	0.321	0.015
2001	0.086	0.036	0.063	0.325	3.269	0.305	0.013
2002	0.081	0.028	0.046	0.267	3.057	0.305	0.012
2003	0.071	0.023	0.035	0.224	2.659	0.270	0.010

For vehicles retired in 2008, the replacement LEV emission rates by model year are:

LEV Model Year	ROG Exhaust g/mile	ROG Evap Running Loss g/mile	ROG Evap Hot Soak g/trip	ROG Evap Diurnal+Resting g/day/vehicle	CO Exhaust g/mile	NOx Exhaust g/mile	PM10 Exhaust g/mile
1997	0.112	0.095	0.173	0.725	4.094	0.358	0.021
1998	0.106	0.084	0.151	0.645	3.976	0.354	0.020
1999	0.101	0.074	0.130	0.568	3.821	0.342	0.018
2000	0.096	0.062	0.109	0.494	3.658	0.329	0.016
2001	0.091	0.050	0.086	0.408	3.466	0.315	0.014
2002	0.088	0.036	0.062	0.324	3.321	0.322	0.014
2003	0.081	0.029	0.046	0.269	3.033	0.301	0.012
2004	0.053	0.023	0.035	0.224	1.989	0.185	0.011

Note: Emission rates calculated using EMFAC Working Draft 2B (June 2006). Numbers are subject to change pending final version of emission inventory model.

- The VMT of the replacement vehicle is equal to the VMT of the retired vehicle.

c. Evaporative Emission Reductions

- Evaporative emission reductions are calculated using the methodology for conventional VAVR programs if no evaporative testing is conducted on the retired vehicle. The reductions, based on the retired vehicle's model year, are listed in Table 11-2.

- Districts may, at their option, conduct evaporative testing on vehicles identified as exhaust high emitting vehicles to determine whether they are evaporative high emitting vehicles as well.

  – Low pressure fuel evaporative testing must be conducted using equipment that has been submitted to BAR for certification.

  – Evaporative testing must be conducted in accordance with the manufacturer's standard operating procedures and the protocols for low pressure fuel evaporative testing developed by BAR.

  – Only vehicles that fail the low pressure fuel evaporative test are eligible to receive extra emission reductions as a high evaporative emitter.

  – For vehicles identified as high evaporative emitters, the emission reductions for retirement are equal to the evaporative emission reductions for conventional VAVR listed in Table 11-2 plus the average emission reductions for repairing evaporative system failures estimated by ARB staff in its evaluation of the low pressure evaporative test, 14.5 pounds of ROG per vehicle per year.

d. Particulate Matter Emission Reductions

- PM exhaust emission reductions are calculated using the methodology for conventional VAVR programs. The reductions are based on the retired vehicle's model year and are found in Table 11-2.

- If a viable method to measure and correlate PM emissions from vehicles is demonstrated and validated, districts have the option of measuring the PM emissions of vehicles identified as possible high emitters and quantifying the extra emission reductions of retiring PM high emitting vehicles, subject to ARB approval.

- If a district intends to attempt to identify and quantify emission reductions from retiring PM high emitting vehicles, the district's program plan must specify the analytical approach that would be used to measure PM emissions.

3. VRV Emission Reductions

- Emission benefits are calculated from the difference between the pre and post-repair Smog Check test where the post-repair test is a full test, not a "fast pass" test.

- The pre and post repair Smog Check testing should be as close to the time of repair as possible.

- To calculate pre- and post-repair emission rates, the pollutant concentrations measured in the ASM test are converted to an FTP based gram per mile emission rate using the conversion equations listed in Table 11-3.

- The VMT is the average VMT of the vehicle's model year based on the ARB's motor vehicle emission model. Average VMT for each model year is listed in Table 11-4.

- The life of the emission credit for exhaust and evaporative repairs is one year.

- The mass emission reduction is equal to the gram per mile emission reduction multiplied by the VMT multiplied by the one year credit life.

Emission Reductions = $[ER_{pre\text{-}repair} - ER_{post\text{-}repair}]$* VMT * Life

Where:

$ER_{pre\text{-}repair}$	=	Emission rate of vehicle prior to repair, based on pre-repair Smog Check converted to gram per mile rate using ASM-FTP conversion
$ER_{post\text{-}repair}$	=	Emission rate of vehicle after repair, based on post-repair Smog Check converted to gram per mile rate using ASM-FTP conversion
VMT	=	Vehicle miles traveled of vehicle
Life	=	Life of repair = 1 year

- For vehicles identified as high evaporative emitters via the low pressure evaporative test and repaired, emission reductions are equal to the average emission reductions for repairing evaporative system failures estimated by ARB staff in its evaluation of the low pressure evaporative test, 14.5 pounds of ROG per vehicle per year.

4. Modifications to Calculation Methodology for VAVR and VRV

- Air districts retain the option of proposing modifications to the calculation methodology, where necessary, to reflect unique elements of their program. Districts must provide technical justifications to support any proposed modifications to the default methodology in their program plan. The district must receive written approval from the ARB to use a modified methodology.

  – If a district receives approval to use a modified calculation methodology, emission reductions for all vehicles retired or repaired must be calculated in accordance with that approved methodology.

F. Cost-Effectiveness Calculations

- Cost-effectiveness must be calculated in accordance with the methodology described in Appendix C of *The Carl Moyer Program Guidelines – Approved Revision 2005*.

- State funds used to pay for the administrative costs of VAVR and VRV programs are not included in the cost-effectiveness calculations, but must be accounted for relative to the administrative limits associated with each funding source. Administrative costs include funds spent on outreach, data analysis, and development of data analysis tools such as databases.

<u>Additional Requirements for High Emitter VAVR and VRV Programs</u>

- The district must include the State or DMV funds expended on program-related costs to identify and retire/repair high emitting vehicles in the cost-effectiveness calculations.

  – Program-related costs are the costs directly linked to conducting RSD measurements, Smog Check tests, diagnosing vehicles, and the costs to retire vehicles or repair vehicles.

  – Broad programmatic costs (e.g. the cost of RSD) which cannot be attributed to retiring a specific vehicle shall be distributed proportionally across each vehicle repaired or retired.

  – All State funds used to pay for diagnosing and attempting to repair vehicles that are ultimately deemed unrepairable or are unsuccessful in lowering emissions below the Smog Check emission standards must also be included into the cost-

effectiveness calculations. These costs shall be distributed across each vehicle successfully repaired.

- The program cost-effectiveness shall be calculated separately for VAVR and VRV programs and for each year of program funding. The results shall be reported in the district's annual and final report for that year of funding.

- If the district has a cap on the amount it pays for repairs, vehicle owners may contribute their own funds to pay for repairs that exceed the district cap. Funds contributed by vehicle owners are not included in the cost-effectiveness calculation.

G. Offering Vehicles/Parts to the Public (VAVR only)

- The enterprise operator must inform the district of the vehicles that are ready for dismantling.

- The district must provide a detailed description of the vehicle to interested parties including collectors and enthusiasts.

- The enterprise operator must wait a minimum of 10 days before submitting a Notice to Dismantle to the DMV.

- If an interested person contacts the enterprise operator, the enterprise operator must hold the vehicle for an additional, minimum of 7 days.

- Non-emission-related and non-drive train parts from the vehicle may be sold at the sole discretion of the enterprise operator.

- Engine, emission-related parts, transmission, and drive train parts must be removed from the vehicle and destroyed after the 10 day waiting period but prior to offering the remaining parts for sale. (Emission-related and drive train parts are defined in the VAVR regulation.)

- If a vehicle or its emission-related or drive train parts are sold instead of retired, no emission reductions will be generated, and no Carl Moyer Program funds may be used for retiring the vehicle.

H. Repair Requirements (VRV only)

- Vehicles must only be diagnosed and repaired by Smog Check technicians licensed by BAR at Smog Check stations licensed by BAR.

- The Smog Check technicians and Smog Check stations must comply with all California laws and regulations governing automotive repair.

- The legal owner of the vehicle must provide written approval in advance authorizing the diagnosis and all repairs. The owner must be provided a final invoice detailing the cost of parts, labor, and tax for the repair in accordance with the Automotive Repair Act.

- Only emission-related repairs are fundable through a VRV program.

- Stations and technicians must follow a systematic diagnostic approach, in accordance with standard industry protocols, that obtains relevant data about the engine and emission control system on the vehicle, based on the type of emission-related Smog Check failure.

  - The systematic approach includes a diagnostic routine that provides sufficient data to diagnose and repair emission failures in a cost-effective and efficient manner. Data may include, but, are not limited to, compression readings, leak down percentages, intake manifold vacuum readings, scan tool data, condition of grounds, other electrical connections along with wiring, oxygen sensor testing, and other industry accepted factory testing procedures. Diagnostic and repair procedures specified by the vehicle manufacturer should take precedence over generic procedures.

  - The diagnosis must ensure the vehicle's engine is in good mechanical condition before performing repairs. This should include an inspection of basic engine operation (i.e., fuel control, individual cylinder contribution, cylinder seal, internal engine noises, oil burning, etc.) and a comprehensive visual inspection. All defects must be noted.

  - Diagnostic strategies must have the goal of maximum emission reductions for repair funds spent. Technicians must not perform diagnostic strategies and repairs that would result in short term emission reductions or minimal reductions.

- The technician must document all serviceable and defective emission related parts and systems found during the diagnosis and repair process and must provide the documentation to the district. The district must retain a copy. The ARB recommends that districts provide a standardized diagnostic form to aid technicians in recording basic diagnostic information.

  - An example of a standardized diagnostic form, from BAR's training course for Smog Check technicians, is provided in Figure 11-1 (at the end of the chapter).

  - It may not be necessary to fill out the diagnostic data form completely because all the tests listed may not be appropriate for every vehicle.

  - The diagnostic form should be considered a guide, not a list of the complete diagnosis required. The ARB recognizes that each vehicles diagnosis is unique. Other tests may be required to completely diagnose emission failures.

- If the technician discovers tampering during the pre-repair test or during the diagnosis, the technician must stop performing the test, diagnosis, or repair and contact the district to inform them of the tampering. Tampered vehicles are not eligible for participation in a VRV program until such tampering has been completely corrected.

- If a vehicle repair requires the replacement of the catalytic converter, the replacement catalytic converter must either be a new aftermarket catalytic converter that has been certified by the ARB for use on OBDII-equipped vehicles or an original equipment manufacturer (OEM) catalytic converter. Because of significant concerns about verifying catalytic converter durability, no used, recycled, salvaged, rebuilt, or remanufactured aftermarket or OEM catalytic converter may be installed under the Voluntary Repair of Vehicles program.

- To receive emission credit under the Carl Moyer Program, the repair of the vehicle must bring the vehicle's emissions into compliance with the Smog Check emissions standards for the model year and vehicle class. Repairs that leave a vehicle's emissions greater than the ASM emissions standards are not creditable.

- The invoice for the repair must clearly detail each repair and associated cost, in accordance with all applicable automotive repair laws and regulations, before the invoice is paid. The invoice must include all repairs performed on the vehicle.

- The district must designate a qualified staff person or third party unaffiliated with the Smog Check station to handle complaints or disagreements that may arise between the vehicle owner and the repair station. The contact information for that person must be made available to all vehicle owners who participate in the program.

  – The district should maintain a record of disputes and their resolution for use in evaluating and improving the program.

<u>Evaporative Repairs</u>

- Districts may, at their option, conduct evaporative testing on vehicles identified as potential exhaust high emitting vehicles and brought in for repairs.

- Low pressure fuel evaporative testing must be conducted using equipment that has been submitted to BAR for certification. Stations must follow testing and repair procedures prescribed in policy or regulations adopted by BAR.

- Evaporative testing must be conducted in accordance with the manufacturer's standard operating procedures and the protocols for low pressure fuel evaporative testing developed by BAR.

- Only vehicles that fail the low pressure fuel evaporative test are eligible for evaporative repairs.

- Evaporative repairs must bring the vehicle's emissions into compliance with the low pressure fuel evaporative test to be creditable.

Particulate Matter Repairs

- If a viable method to measure PM emissions from vehicles is demonstrated, districts have the option of measuring the PM emissions of vehicles identified as possible high emitters and quantifying the emission reductions of repairing PM high emitting vehicles, subject to ARB approval.

- If a district intends to attempt to identify and quantify emission reductions from repairing PM high emitting vehicles, the district's VRV program plan must specify the analytical approach that would be used to measure and quantify PM emissions.

Table 11-2

Voluntary Accelerated Light-Duty Vehicle Retirement Program
Emission Reductions for Calendar Year 2007

Total Pounds Per Vehicle Over 3 Year Credit Life

	Emission Reductions (pounds) – 3 Year Credit Life					
Model Year	**TotalROG***	**NOx**	**CO**	**PM10**	**ROG exh**	**ROG evap**
65 and earlier	506	158	2,999	0.74	279	227
66	472	152	2,771	0.81	239	233
67	479	154	2,823	0.77	243	236
68	487	159	2,889	0.83	249	239
69	498	163	2,967	0.99	255	243
70	431	167	3,056	1.04	261	170
71	436	169	3,053	1.13	270	166
72	442	172	3,059	1.06	279	163
73	448	173	3,070	0.97	284	165
74	386	152	2,821	1.20	264	122
75	320	137	2,656	1.03	207	113
76	215	110	2,246	0.75	104	111
77	173	93	2,203	0.63	90	83
78	177	92	2,191	0.88	91	86
79	161	82	1,455	0.86	77	84
80	124	74	1,211	0.69	59	65
81	105	56	934	1.16	45	59
82	102	59	920	1.04	44	58
83	92	62	795	0.91	34	58
84	99	62	752	0.93	32	67
85	92	57	490	0.86	24	68
86	89	57	446	0.89	23	66
87	80	55	407	0.80	22	58
88	72	55	371	0.77	22	50
89	51	44	424	0.71	24	27
90	49	34	450	0.68	25	24
91	44	35	438	0.63	25	19
92	42	36	434	0.60	25	17
93	32	34	253	0.55	18	14
94	19	22	40	0.49	7	12

* Includes exhaust and evaporative emissions

Source: Calculated using EMFAC Working Draft 2B (June 2006). Numbers are subject to change pending final version of emission inventory model. Assumes average 1965 through 2007 vehicle as replacement vehicle for vehicles retired in calendar year 2007.

Table 11-2 (continued)

Voluntary Accelerated Light-Duty Vehicle Retirement Program
Emission Reductions for Calendar Year 2008
Total Pounds Per Vehicle Over 3 Year Credit Life

	Emission Reductions (pounds) – 3 Year Credit Life					
Model Year	**TotalROG***	**NOx**	**CO**	**PM10**	**ROG exh**	**ROG evap**
65 and earlier	503	159	2,993	0.73	278	226
66	470	152	2,760	0.69	240	230
67	478	155	2,812	0.70	244	234
68	487	159	2,879	0.72	250	237
69	497	163	2,956	0.75	257	240
70	431	167	3,047	1.23	263	168
71	439	170	3,047	0.84	272	167
72	443	171	3,050	0.88	281	162
73	450	173	3,063	0.79	285	165
74	388	155	2,835	1.39	267	122
75	324	143	2,686	0.98	210	114
76	212	109	2,209	0.79	103	110
77	171	92	2,160	0.67	88	83
78	173	92	2,144	0.66	89	85
79	160	82	1,436	0.91	76	84
80	122	74	1,195	0.74	58	64
81	104	56	928	1.00	45	59
82	102	60	912	0.92	43	58
83	93	63	791	0.84	34	58
84	100	63	751	0.84	32	68
85	95	57	499	0.89	25	70
86	94	58	466	0.90	24	70
87	85	57	428	0.83	24	62
88	77	56	395	0.80	23	54
89	56	45	445	0.77	25	31
90	54	36	470	0.76	26	28
91	49	37	460	0.72	27	22
92	47	38	456	0.66	27	20
93	37	36	278	0.60	20	18
94	25	25	73	0.56	10	15

* Includes exhaust and evaporative emissions

Source: Calculated using EMFAC Working Draft 2B (June 2006). Numbers are subject to change pending final version of emission inventory model. Assumes average 1965 through 2008 vehicle as replacement vehicle for vehicles retired in calendar year 2008.

Table 11-3
ASM-FTP Correlation Equations[1]

Pre-1990 Model Year Correlation Equations

FTP_HC = 1.2648 * exp(- 4.67052
+ 0.46382 * hc_term
+ 0.09452 * co_term
+ 0.03577 * no_term
+ 0.57829 * wt_term
- 0.06326 * my_term
+ 0.20932 * trk)

FTP_CO = 1.2281 * exp(- 2.65939
+ 0.08030 * hc_term
+ 0.32408 * co_term
+ 0.03324 * co_term**2
+ 0.05589 * no_term
+ 0.61969 * wt_term
- 0.05339 * my_term
+ 0.31869 * trk)

FTP_NOX = 1.0810 * exp(- 5.73623
+ 0.06145 * hc_term
- 0.02089 * co_term**2
+ 0.44703 * no_term
+ 0.04710 * no_term**2
+ 0.72928 * wt_term
- 0.02559 * my_term
- 0.00109 * my_term**2
+ 0.10580 * trk)

where: hc_term = ln((ASM1_HC*ASM2_HC)^.5) - 3.72989
co_term = ln((ASM1_CO*ASM2_CO)^.5) + 2.07246
no_term = ln((ASM1_NO*ASM2_NO)^.5) - 5.83534
MY_Term = model_year - 1982.71
wt_term = ln(vehicle_weight in pounds)
TRK = 0 if vehicle is a passenger car and 1 if vehicle is a light-duty truck

[1] Conversion equations developed by Eastern Research Group and Sierra Research and used in the ARB and BAR's *2004 Evaluation of the California Enhanced Inspection and Maintenance (Smog Check) Program*.

1990 and Newer Model Year Correlation Equations

FTP_HC = 1.1754 * exp(- 6.32723
+ 0.24549 * hc_term
+ 0.09376 * hc_term**2
+ 0.06653 * no_term
+ 0.01206 * no_term**2
+ 0.56581 * wt_term
- 0.10438 * my_term
- 0.00564 * my_term**2
+ 0.24477 * trk) ;

FTP_CO = 1.2055 * exp(0.90704
+ 0.04418 * hc_term**2
+ 0.17796 * co_term
+ 0.08789 * no_term
+ 0.01483 * no_term**2
- 0.12753 * my_term
- 0.00681 * my_term**2
+ 0.37580 * trk) ;

FTP_NOX = 1.1056 * exp(- 6.51660
+ 0.25586 * no_term
+ 0.04326 * no_term**2
+ 0.65599 * wt_term
- 0.09092 * my_term
- 0.00998 * my_term**2
+ 0.24958 * trk)

where: hc_term = ln (ASM1_HC*ASM2_HC)^.5) - 2.32393 ;
co_term = ln (ASM1_CO*ASM2_CO)^.5) + 3.45963 ;
no_term = ln (ASM1_NO*ASM2_NO)^.5) - 3.71310 ;
MY_Term = model_year - 1993.69;
wt_term = ln(vehicle_weight in pounds)
TRK = 0 if vehicle is a passenger car and 1 if vehicle is a light-duty truck

For cases in which the HC or NO ASM scores are zero, they are set to 1 ppm;
for cases in which the CO ASM score is zero, it is set to 0.01%.

Definitions: FTP_HC = Estimated hydrocarbon FTP emission rate in grams per mile
FTP_CO = Estimated CO FTP emission rate in grams per mile
FTP_NO = Estimated NOx FTP emission rate in grams per mile
ASM1_HC = Measured ASM 5015 mode hydrocarbon concentration in ppm
ASM2_HC = Measured ASM 2525 mode hydrocarbon concentration in ppm
ASM1_CO = Measured ASM 5015 mode CO concentration in percent
ASM2_CO = Measured ASM 2525 mode hydrocarbon concentration in percent
ASM1_NO = Measured ASM 5015 mode NOx concentration in ppm
ASM2_NO = Measured ASM 2525 mode NOx concentration in ppm

Table 11-4
Average Vehicle Miles Traveled by Model Year

Model Year	Annual VMT* in 2007	Annual VMT* in 2008
1965 and older	5,173	5,118
1966	5,250	5,164
1967	5,350	5,264
1968	5,485	5,400
1969	5,635	5,550
1970	5,786	5,698
1971	5,910	5,823
1972	6,048	5,955
1973	6,132	6,039
1974	6,163	6,068
1975	6,312	6,212
1976	6,376	6,269
1977	6,475	6,364
1978	6,544	6,433
1979	6,636	6,520
1980	6,701	6,586
1981	6,794	6,676
1982	6,893	6,771
1983	6,998	6,870
1984	7,172	7,042
1985	7,306	7,168
1986	7,497	7,360
1987	7,600	7,456
1988	7,763	7,615
1989	7,943	7,787
1990	8,108	7,942
1991	8,317	8,143
1992	8,538	8,346
1993	8,787	8,582
1994	9,022	8,801
1995	9,252	9,010
1996	9,540	9,280
1997	9,834	9,552
1998	10,176	9,866
1999	10,546	10,205
2000	10,912	10,529
2001	11,328	10,897
2002	11,824	11,324
2003	12,411	11,819
2004	13,150	12,426
2005	13,983	13,064
2006		13,999

*Average vehicle VMT calculated using EMFAC Working Draft 2B (June 2006). Numbers are subject to change pending final version of emission inventory model.

Figure 11-1
Sample Diagnostic Data Form[2]

DIAGNOSTIC DATA FORM

The following chart is designed to assist the CAP station technician in the diagnosis and repair of failing CAP vehicles. Each vehicle and its emission failure(s) are unique and may require further tests than those listed below. Not all vehicles may require these tests.

Factory test procedures take precedence over any generic test.

WRITE YES (Y), NO (N) OR READING/EXPLAINATION. DO NOT CHECK

CAP ID#	Year / Make / Model	Vehicle License #	Technician #	Date
			Work order #	

Confirm basic engine condition:

Engine condition: any smoking, knocking, head gasket leaks or any other degraded engine condition(s)? _____

(*As needed*) compression test, cylinder balance test, leak down test results (whichever test was appropriate)

#1 _____ #2 _____ #3 _____ #4 _____ #5 _____ #6 _____ #7 _____ #8 _____

Base timing _____ Total timing advance _____ Coolant Temp _____ Vacuum readings _____

Ignition system: overall condition, are there any misfires? (HC failures) What is the specific component of the ignition system that needs to be replaced / repaired? List below

_____

Fuel pressure within specs? Y/N _____ results_____

Air Injection System (if applicable) Is AIS functioning correctly? Y/N_____ if no, why _____

EGR system (if applicable) Is system functioning correctly? Y/N _____ Is valve getting vacuum? Y/N _____

Does engine stumble/die when valve is manually raised? Y/N _____ Is EGR valve defective? Y/N _____

Is system restricted? Y/N:_____ Is system plugged? Y/N _____ Other:_____

Are there any Factory Technical Service Bulletins (TSBs), recalls/warranties related to the emission failure? _____

Are there any Diagnostic Trouble Code(s) stored? If yes, are they emission related? If yes, record code(s) _____

If vehicle is OBDI did you clear the codes and did they return? If vehicle is OBDII what is recorded in "Freeze Frame Data"?

Is vehicle failing for monitors? _____

Oxygen Sensor: Low Voltage: _____mV High Voltage: _____mV Rise time: _____mS

NOTE: min/max/rate of change measured while artificially manipulating air/fuel mixture full rich & full lean.

Average voltage: _____ Is O2 sensor functioning correctly? _____

Is vehicle in fuel control? Y/N_____ If no is O2 biased? Rich Y/N _____ Lean Y/N _____

Will computer respond to an artificial O2 signal? Y/N, if no, why?

_____

What are fuel trim numbers under test conditions? _____

Cross-reference the failed emission(s) with the related failed test.

Final Diagnosis / What component(s) or system(s) need to be repaired or replaced and why

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CATALYTIC CONVERTER DIAGNOSTIC ROUTINE

Factory diagnostic/testing procedures take precedence over generic tests.

Cat tests are valid or useful to the extent the vehicle is in fuel control. CAT tests require certain conditions be created by upstream systems in order to be valid. Fuel control is not just a varying O2S and/or fuel metering device. Fuel control is defined as the vehicle's ability to control fuel in response to the O2S input signal keeping the air/fuel ratio at 14.7 to 1 (stoichiometric). CAT replacement is generally the last repair approved.

Do not request a CAT with other repairs associated with its efficiency.

DO NOT REQUEST A CAT ON A VEHICLE THAT IS NOT IN FUEL CONTROL.

RECORD ON THE WORK ORDER "THE VEHICLE IS IN FUEL CONTROL".

O2 snap test	CO2 cranking test	Pre CAT / Post CAT (intrusive test)	Factory specific temperature test
O2% ____ %	HC: _____ ppm	Pre CAT: _____ Post CAT: _____	temp in _____ temp out _____
	CO2: _____	CAT efficiency: _____%	

Two CAT tests are more conclusive than one. A generic temperature test alone is not acceptable. Temperature tests are best used to confirm another test. An intrusive test is an optional test to confirm the effectiveness of the reduction portion of the catalyst.

[2] Sample diagnostic form from BAR's training course to licensed Smog Check technicians. Not all fields may be relevant for district VRV program. Districts may design their own forms if they choose.

VI. References

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